AN earthquake took place in the beginning of October on the Isthmus of Chiriqui near Panama.

DR. ROBERT BROWN, in a communication on the "Interior of Greenland," states that all the results of the attempted explorations of the interior serve to show that this is one huge *mer de glace*, of which the outlets and overflow are the comparatively small glaciers on the coast, though when compared with the glacier system of the Alps, they are of gigantic size. The out-skirting land is, to all intents and purposes, merely a circlet of islands of greater or less extent. There are, in all probability, no mountains in the interior—only a high plateau, from which the unbroken ice is shed on either side to the east and west, the greater slope being toward the west. No mountains have been seen in the interior, the prospect being generally bounded by a dim, icy horizon. Dr. Brown considers Greenland susceptible of being crossed from side to side with dog or other sledges, provided the party start under experienced guides, and sufficiently early in the year.

OCCASIONAL glimpses of pre-historic times are afforded to us. One of the Indian papers records the deeds of a mad elephant, which made its way from the Rewah territory into the Mundla district. The first day it attacked the village of Tarraj, when the inhabitants took refuge on the roofs, but it killed a woman and child. The next night it went to the village of Mauzah and killed a boy. Two days after it killed a woman at Barbashore, and on the following night added to the number a man and woman at Kamaria. Thence it made its way to Donoria, and the villagers tried to escape, but two old women met their death, and another was trampled on and seriously injured. Its next stage was Manori, destroying a woman and two children, and so to Karbah. Here it snatched a baby from the mother's arms and killed it, and in the evening succeeded in killing a man in the same place. The next night a man was killed at Nigheri, and on that following another at Banu. On the 7th February it met with a check in passing the Ramgurgh Tahsil, where it was fired on, and retreated to Bijori, taking revenge by killing a man and a boy. On the 8th it surprised a party of villagers in the jungle, who had escaped from Nanda, again taking a woman's baby from her arms and killing it. The next slaughter was of a man at Belgaon and another at Belgara. It then visited Sayla, the villagers making their escape, except one boy, who was caught by it, but only rolled about for fun, but the elephant went into the village and pulled down several houses. By the 15th he was at Mohari, and injured a man and woman by rolling them about without killing them. On the 19th it killed one man and wounded another at Naraingunj. By this time a party was got together to resist it, about three weeks having elapsed, and the animal was driven across the river Nerbudda and into the jungle of a hill, but from which the force was inadequate to dislodge it. In three weeks it drove the people out of many villages, killing twenty-one persons, wounding others, and ravaging the country. It is alleged to have devoured five of its victims. The above recital of what took place in a relatively settled country, gives colour to the legends of Hercules and Theseus. In this case nothing is said of the destruction of crops which must have taken place.

AN improvement in the apparatus attached to fire-engines has been proposed by Mr. Prosser in the form of a spreading fire-nozzle, the object of which is, by means of a number of moveable as well as fixed fingers so to direct the jet of water that it shall divide it into a more or less fine spray. The water is thus economised, and instead of a large proportion running off after scarcely coming into contact with the burning material, every drop, falling in the form of a conical shower of rain, performs its part towards extinguishing the fire.

COLDING ON THE LAWS OF CURRENTS IN ORDINARY CONDUITS AND IN THE SEA

II.

FORCHHAMMER has filled up that gap by his researches upon the water of the ocean; for we can now, by the help of his results and of the temperatures, ascertain pretty exactly the specific weight of the water of the ocean in the principal seas of the globe. Calculation has proved the correctness of Maury's original notion, viz., that the density of the water of the ocean is least at the equator, and increases with tolerable regularity in proportion as we advance towards the north and towards the south. The water of the Atlantic seems to be of the greatest density at about 60° N. latitude to the south and south-east of Greenland. If we take this density as unity, the specific weight of the water of the sea will on an average be represented by the following numbers:—

NORTHERN HEMISPHERE		SOUTHERN HEMISPHERE	
Between 60° and 70° latitude in Davis Straits .	0·9980	Unknown	
About 60° latitude in the Atlantic	1·0300	Unknown	
Between 50° and 60° latitude in the Atlantic . .	0·9994	In the Cold Currents of Cape Horn	0·9990
Between 40° and 50° latitude in the Atlantic . .	0·9985	In the Atlantic	0·9984
Between 23° and 40° latitude in the Atlantic . .	0·9972	In the Atlantic	9·9970
Between 0° and 23° latitude in the Atlantic . .	0·9966	In the Atlantic	0·9966

Of these the former, those of the Northern Hemisphere, are most to be depended on, because the observations there have been most numerous.

It will be seen by this table that the density of the water of the ocean increases along with the latitude, and in almost the same proportion both north and south of the equator. But Forchhammer has also determined the saltness of the sea at various depths, and has found that it decreases in very slow proportion with the increase of the depth. It we start from this fact, taking account at the same time of the decrease of temperature in proportion to the depth, we find the result to be that, at 500 fathoms below the surface, the density of the water of the sea over the whole globe may be considered as equal to 1, the difference at any particular point being scarcely discernible. But since the density of the water of the ocean at a depth of 3,000 feet is everywhere equal to 1, and since at the surface it diminishes as we approach the equator, it is evident that the mass of water underneath cannot be in equilibrium; that if the surface of the sea is more elevated between the tropics than under the poles, and if we take the mean densities given above, at the surface, and at the bottom of this liquid mass, we find that the height of the surface of the sea above the level corresponding to the density of 1, ought to be nearly as follows:—

Height between the Equator and the Tropics 6·6 feet.
" " Tropics and 40° lat. . 4·2 "
" " 40° and 50° " 2·2 "
" " 50° and 60° " 0·9 "
" at 60° " 0·0 "
" between 60° and 70° " 3·0 "

But a similar difference of level necessitates the formation of a double surface-current passing from the equator to the two poles, and that cannot take place without entailing a diminution of the height of the water under the tropics, unless, indeed, there be an equivalent afflux into the tropical seas. But if the level of the water between the tropics be lower, the equilibrium of the under strata will be destroyed, and there ought, consequently, to be a submarine current which comes both from the north and the south towards the equator. That there really exists a current in that direction is a result of the circumstance that the temperature of the sea decreases with the depth.

Supposing then that there were no other forces in action, the difference of level mentioned above, ought, as Maury at first admitted, to give rise to a surface-current from the equator to the poles, and an under-current from the poles to the equator. But these currents are enormously modified by the intervention of other forces. The north-east trade-winds react against this equatorial current of the northern hemisphere, exercising upon the surface of the sea an oblique pressure, of which the effect is greater than that of the difference of level. There results from this, reckoning from the 30° latitude, a rising of the water in a direction contrary to the liquid masses which the south-east trade-winds tend to draw from the south Atlantic; at the same time the north-east trade-winds force the waters of the surface, as Franklin supposed, to take a south-western direction towards the Carribean Sea. In this sea, and in the Gulf of Mexico, where the trade-winds exercise no influence, the water continues its course to the north by the Strait of Florida, and thus gives birth to the Gulf Stream. But in order to enable the Gulf Stream to advance from the Gulf of Mexico and the Strait of Florida as far as 30° N. latitude, a difference of level is necessitated, which can be calculated by the help of the general formulæ for the movement of water in currents; by this means we find that the level of the water in the Gulf of Mexico ought to be about 6 feet higher than at St. Augustine. If we then observe that in accordance with the density of the water at St. Augustine, the level of the sea ought to be found to be about $3\frac{1}{2}$ feet above the point marked zero, which corresponds to the mean density of 1, it follows that the level of the Gulf of Mexico is about $9\frac{1}{2}$ feet above that point, and that the trade-winds are the means of adding a height of 3 feet to the water of that gulf.

After this immense current—which, in the Strait of Bemini, may be compared to a river delivering at the rate of 1,600,000,000 cubic feet per second—has passed St. Augustine, it pursues its course to the north-east, as has been said above. In order to accomplish this long passage, it has at its disposal, at the most, an incline of $3\frac{1}{2}$ feet; but it is easy to see that the force which results from this is altogether insufficient to accomplish the work which this movement demands, and it evidently follows that the Gulf Stream ought, during all this course, to be subjected to the action of another force, to which hitherto our attention has not been drawn. But what is this force of which we have thus taken no notice? Singularly, it is an old acquaintance, whose function we have not sufficiently understood, although Kepler was the first to announce its importance. In fact, the force which impels the Gulf Stream towards the north is simply that which results from the rotation of the Earth; and it acts not only upon the Gulf Stream, but is, as we shall see, the chief cause of all currents, both atmospheric and marine. That the daily rotation of the earth should exercise an influence upon all currents which go from the equator to the poles and *vice versâ*, and that the direction of the trade winds are due to the same cause, are facts well known. But though it is agreed that this rotation acts upon the currents of the ocean, opinion has hitherto been very much divided as to the importance of the action; some maintaining that the rotation of the earth is the chief cause why the Gulf Stream and the polar currents follow respectively the directions north-east and south-west, while others hold that it cannot cause any change to speak of in the courses taken by the ocean currents, courses which they would continue to follow all the same were there no rotation of the earth. But although there is so much dispute as to this point, every one agrees in acknowledging that we know but little about the matter, and in any case nothing certain of the laws which regulate the movements of the ocean and atmosphere; for we are at present ignorant whether the atoms of water or air move without resistance, or whether they meet and are subject to the action of certain forces, and we know still less about the origin of these forces, their magnitude, &c. This ignorance on the subject of the influence which the rotation of the earth exercises upon the currents is evidently due to the imperfect knowledge which we have of the laws which regulate the movement of fluids in currents; for if we had been able to establish that such a force ought to be in play, we would, without doubt, soon have determined the true expression. The thing is, in fact, very simple; if we suppose that a section of element current flows from the equator in the direction of the meridian in a definite channel, that line will turn with the earth with a speed from west to east $= \frac{2\pi R}{86400} \cos\theta$, θ representing the latitude, and R the radius of the earth. After a time dt, during which the current in question will arise at latitude $\theta + d\theta$, it will act upon the sides of the canal as if it were subjected to a force which, in the time dt, had communicated to it an increase of speed $\frac{2\pi R}{86400} \sin.\theta\, d\theta$ from west to east, the line of current being supposed perfectly free. The force which results from the rotation of the earth could then be represented by

$$\psi = \frac{2\pi R}{86400} \sin.\theta \left(\frac{d\theta}{dt}\right) = \frac{2\pi}{86400} \sin.\theta\, v$$

v being the speed in the supposed channel. But the movement not being free, since the material section which we are considering is forced to move in a channel from south to north, it will exercise per unit of mass against the sides of the canal, a pressure ψ directed from west to east. If the section, as we have supposed, forms part of a current compelled to move circularly in a channel, it is evident that the surface of the water will rise from left to right; and if we designate the height by what it rises by h, for a breadth of channel $= l$, we shall have $-g\frac{h}{l} = \frac{\sin.\theta\, v}{13750}$.

The trajectory being the same, it is clear that the surface of the current ought to present the same slope, whether it moves in a channel or flows freely in the middle of the sea. But it is no less evident that whatever be the situation of this trajectory on the surface of the globe, the section which in the time t is found at latitude θ, and after the infinitely small time dt, arrives at latitude $\theta + d\theta$, ought, under the influence of the rotation of the earth, to move in the same manner as if, the earth being immovable, it had been driven from west to east with a force

$$\psi = \frac{2\pi R}{86400} \sin.\theta \frac{d\theta}{dt} = \frac{\sin.\theta.\sin.w\, v}{13750}$$

where v still represents the speed of the section under consideration, and w the angle which the direction of the trajectory described makes with the eastern part of the circle of latitude. But we can, in consequence, put aside the rotation of the earth, and consider the latter as immovable if to the other forces which act upon the water, we add the force ψ acting from west to east. If we decompose this into two other rectangular forces, one of them following the direction of the current, which, let us suppose, has throughout its course a fall $\frac{du}{d\lambda}$, we find that its surface ought to present from left to right, and perpendicularly to the direction of the current, an elevation $\frac{h}{l}$, whose value is given by the equation

$$(1) \ldots\ldots g\frac{h}{l} = \frac{\sin.\theta \sin.^2 w.\, v}{13750}$$

and that the liquid mass is impelled forward by a force

$$\left[\frac{\sin.\theta \sin.w \cos.w.\, v}{13750} + \frac{du}{d\lambda}g\right]$$

which, in accordance with my theory, leads to the following equation of the movement of the current:—

$$(2)\quad u = \frac{V^2 - V_0^2}{2g} + \frac{0{\cdot}016}{3}\,\frac{V^2 + V.V_0 + V_0^2}{2g}\,\frac{\lambda}{H} + \frac{\sin.\theta \sin.w \cos.w}{13750}.\,\frac{V + V_0}{2g}\lambda$$

where u is the fall of the current in the length λ, H its depth, V_0 its initial speed, and V its final speed after having run the course λ. In short, if, according to the theory, we place for the delivery of the current per second

$$(1) \ldots\ldots 2 = 0{\cdot}82\, V.H.\lambda$$

we shall have the fundamental formulas which give the laws of the course of ocean currents over the whole surface of the globe; the angle θ, which is positive in the northern hemisphere and negative in the southern, having its values comprehended between 0° and 90°, while the angle w, following the direction of movement, may be found in the 1st, 2nd, 3rd, or 4th quadrant.

It follows from these three formulas that all the currents of the northern hemisphere, whatever be their direction, have a surface which goes on rising from left to right, and whose progress, the force resulting from the rotation of the earth, accelerates or retards according as they move in the 1st or 3rd, or in the 2nd or 4th quadrant: hence it follows that a movement in one of these latter quadrants is possible only when the current possesses a sufficient fall, or an equivalent force, due, for example, to the action of the wind, the specific weight of the water of the sea, &c. When the current follows the meridian, the inclination of its surface, perpendicularly to its direction, is at the maximum; but besides this, the rotation exercises no influence upon its course. When the current flows at right angles to the meridian, the fall $\frac{h}{l} = 0$, and the rotation has, in short, no effect upon its course.

If, then, we consider the Gulf Stream from its exit from the Gulf of Mexico, we see that, in its passage from Bemini to St. Augustine by the Strait of Florida, where it runs directly north, the current is kept up by a difference of level which, as has been stated above, may, for that extent, be estimated at six feet. Throughout this course the current presents from west to east an elevation whose total value is about 1 3 feet.

From St. Augustine to the Bay of New York the Gulf Stream runs towards the north-east; in all this course it is impelled by the rotation of the earth with a force corresponding to a fall of from nine to ten feet, and rises from left to right about 1·2 feet.

From the Bay of New York the Gulf Stream runs eastward towards the shores of Europe, and, throughout the passage, obeys the impulse of the force of rotation, which raises it from left to right by a total elevation of about one foot. Having reached the neighbourhood of Europe, the current divides into two nearly equal branches, one of which, under the influence of the diminished force of the action of the earth's rotation, runs in a south-easterly direction towards the coast of Africa, with an elevation from left to right. The other branch, meanwhile, is forced to skirt the coasts of Great Britain, taking a more northerly direction on account of the resistance it meets with from the land, the action of the force of rotation causing it to advance in its northerly course with an elevation from left to right facing the land of one and-a-half feet. If we try to estimate the influence which the earth's rotation exercises upon the Gulf Stream from St. Augustine to the 60th degree of N. latitude, we find that the force is nearly the same as that which would act upon the current, if, between these two points, a distance of about 950 miles, the Atlantic showed a difference of level of twenty-five feet. When the Gulf Stream has passed the northern extremity of Scotland, the resistance which obliged it to take a more northerly direction disappears, and, from this time, the principal current inclines more to the east towards the coast of Norway, which it then skirts to the north-east, sloping towards the land on account of the earth's rotation. Another branch of the Gulf Stream is arrested by Iceland in its course to the north, and turned to the north-west, striving against the earth's rotation, which elevates it towards the south and south-west coast of the island just mentioned, it ought consequently to present a slope towards the north-west as far as the polar current.

(*To be continued.*)

SCIENCE IN GERMANY*

IN his address at the opening of the present University Session at Berlin, the out-going Rector quoted some interesting figures showing the effect of the recent war on the activity of the University. In October 1870 there matriculated in all the faculties 1,236 students, while the number of entries for the winter session of 1869 was 2,421. Of the 1,236 students who entered their names in October, only 904 continued their attendance throughout the winter. The actual number of medical students last winter was 173, while in the previous winter session they amounted to 550. The falling off in numbers extended about equally to all the four faculties; but it appears that none of the theological students who entered at the beginning of the session were required to break off their studies. The courses of lectures, public and private, that were announced amounted to 366, and of these 271 actually came off. Forty students took their degrees—8 in jurisprudence, 19 in medicine, and 13 in philosophy. The number of deaths, so far as was ascertained, amounted to 32. The University seems now to have returned to its full activity, to judge from the crowded state of many of the class-rooms. A few of the students are to be seen wearing the ribbon of the Iron Cross.

Two ladies from America have applied to the Berlin University authorities for permission to attend the medical classes. One lady, a Russian, is studying chemistry in Prof. Hofmann's laboratory. An American lady has been studying medicine at Breslau, and has sent to an American newspaper a glowing account of her friendly reception at the Silesian University. Another pioneer of the same sex is studying engineering at the Polytechnic School of Aix-la-Chapelle; and two ladies recently joined the University of Prague, where they are studying under the professor of history. During the past summer a solitary American lady, M.D., attended the clinics at the Vienna General Hospital, and appeared to suffer, to the full extent, the inconveniences of being in so considerable a minority.

The autumn season on the Continent, as in England, is marked by the occurrence of various scientific gatherings. At several of these, Prof. Virchow has been receiving invitations, which the Berlin newspapers have chronicled from time to time. At the Assembly of German Naturalists and Physicians, held at Rostock, his speech was the great event of the meeting. During the Bologna Conference of Archæologists, he was entertained at a banquet by the Italian dignitaries and men of science; and at a scientific assembly held in Rome, the audience rose to their feet to welcome the celebrated Berlin professor, who made them a speech in French. In his address to the Rostock Conference, Virchow made some remarks upon the nature of annual scientific gatherings, of which he himself is an assiduous frequenter. "It was a matter of encouragement to me," he said, "when I read in the proceedings of the recent meeting of the British Association, in the opening address of its renowned President, Sir William Thomson, that Brewster, in his letter by which he called the Association into existence, expressly stated that he was led to this step from considering the great and beneficent results that the German Naturalists' Association (*Naturforscherversammlung*) had achieved during its nine years' previous activity. We were the first to advance among all nations; the English followed, and the number of these associations has gradually increased. They have, by degrees, extended into every possible province of human activity, and we have thereby become accustomed, by the co-operation of the many, to define more clearly the common objects at which the whole has to aim." And again, speaking of the results of these meetings, he says: "Not only the pleasures of fellowship, which are inseparable from a great congress of individuals; not only the amenities of personal acquaintance, which cannot be too highly valued; the forming of friendly ties, where perhaps, under other circumstances, harsh and even bitter opposition would have sprung up; the reconciling of many controversial antagonisms through personal intercourse—all this is the smaller result. There is yet a greater—the communication of knowledge, the explanation of methods, the clearing up of the directions in which research should be undertaken—and these are things which can be nowise better told than by word of mouth." The main subject of Professor Virchow's address was the part that science would have to play in the new national life of Germany. Their work, he held, was to introduce into the popular life of the nation the great and all-pervading idea of evolution. Space will not permit even to give an abstract of his views.

Among the books that have issued from the German press within the last month or two are—the new edition of Virchow's "Cellular Pathology," much improved and enlarged; Professor Traube's "Contributions to Physiology and Pathology," in two bulky volumes, one containing experimental and the other clinical researches; a new instalment (the fifth) of Stricker's "Handbuch;" a treatise on Leuchæmia, by Professor Mosler of Greifswald; and an elaborate work with plates, by Barkow of Breslau, on "Dilatations and Tortuosities of the Blood-vessels," with special reference to aneurism of the aorta in its various sites.

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* From a Correspondent of the *British Medical Journal*.

SCIENTIFIC SERIALS

THE fourth number of the *Zeitschrift für Ethnologie* for the present year begins with Dr. A. Erman's concluding part of his "Ethnological Observations on the coasts of Behring's Sea." He draws attention to the bold and often successful surgical treatment which was found to have been practised by the Aleutians when they were first visited by Europeans. The influence exerted by the Russians on these primitive people has tended to make them conceal, or even gradually relinquish the practice of many of their old national habits, and, amongst other usages, they have almost wholly given up their heroic surgical operations. Dr. Erman met, however, with one skilled Aleutian operator, from whom he learned many particulars in regard to the native practice of his art. It would appear that their variously-sized lancets are formed of finely-polished and sharply-edged flakes of obsidian. With these instruments bleeding in the leg as well as the arm is performed, and incisions made in various parts of the body, including the thoracic walls, for the purpose of removing blood or pus, in cases of their effusion into the cavity of the pleura, or in pulmonary disease. But although we are told that this practice is not found to be attended with any dangerous results, we are not informed how the injurious effect of any possible admission of air into the chest is guarded against. The Aleutians exhibit great dexterity in removing various parts of the bodies of whales, and of sea-lions and other seals which they have killed, as, for instance, the mucous membrane of the neck, without in any way injuring the contiguous parts. And they show wonderful skill in fabricating from such membranes thoroughly water-proof and highly elastic coverings for the feet and legs, as well as those invaluable rowing dresses known as "Kamlejkes," which, when drawn over the head and upper part of the body and fastened